ANNEX
BETWEEN
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
AND
BLUE ORIGIN, LLC
UNDER SPACE ACT UMBRELLA AGREEMENT NO. 27616 / SAA2-403403
(ANNEX NUMBER FOUR)

ARTICLE 1. PURPOSE

This Annex to the Reimbursable Space Act Umbrella Agreement SAA2-403403 (the "Umbrella Agreement") between Blue Origin, LLC ("Blue Origin" or "Partner") and NASA Ames Research Center ("NASA" or "NASA ARC") shall be for the purpose of performing aerothermodynamic analysis of a novel entry system to support the characterization of Blue Origin's vehicle. As part of this effort, Computational Fluid Dynamics (CFD) simulations will be performed using NASA's unique aerothermal analysis tools (US3D and DPLR), computational facilities, and best practices. A variety of vehicle configurations and flight conditions will be analyzed, as directed by the Partner.

The NASA Ames performing organization will be the Code TS Entry Systems and Technology Division.

The legal authority for this Annex, consistent with the Umbrella Agreement, is in accordance with the Space Act, Other Transactions Authority (OTA), 51 U.S.C. § 20113(e).

Each capitalized term used in this Annex Four, but not defined herein, shall have the meaning ascribed to it in the Umbrella Agreement.

ARTICLE 2. RESPONSIBILITIES

A. Upon Partner's request and NASA's receipt of advance payment for each task listed below (see Article 4), NASA ARC will use reasonable efforts to:

1. Perform preliminary aero/aerothermal simulation of the Blue Origin vehicle:
    - Deliver aerodynamic coefficient data and aerothermal surface environment maps for two vehicle configurations at one flight condition of interest.
    - Deliver computational grids and solutions for configurations/conditions analyzed.

2. Support aero/aerothermal simulation for Configuration Study 1:
    - Deliver aerodynamic coefficient data and aerothermal surface

environment maps for three vehicle configurations of interest.
    - Deliver computational grids and solutions for configurations/conditions analyzed.
3. Support aero/aerothermal simulation for Configuration Study 2:
    - Deliver aerodynamic coefficient data and aerothermal surface environment maps for three vehicle configurations of interest.
    - Deliver computational grids and solutions for configurations/conditions analyzed.

4. Support aero/aerothermal simulation for Configuration Study 3:
    - Deliver aerodynamic coefficient data and aerothermal surface environment maps for three vehicle configurations of interest.
    - Deliver computational grids and solutions for configurations/conditions analyzed.

5. Support aero/aerothermal simulation for Flight Condition Study 1:
    - Deliver aerodynamic coefficient data and aerothermal surface environment maps for three flight conditions of interest.
    - Deliver computational grids and solutions for configurations/conditions analyzed.

6. Support aero/aerothermal simulation for Flight Condition Study 2:
    - Deliver aerodynamic coefficient data and aerothermal surface environment maps for three flight conditions of interest.
    - Deliver computational grids and solutions for configurations/conditions analyzed.

7. Support aero/aerothermal simulation for Flight Condition Study 3:
    - Deliver aerodynamic coefficient data and aerothermal surface environment maps for three flight conditions of interest.
    - Deliver computational grids and solutions for configurations/conditions analyzed.

8. Participate in bi-weekly meeting to review technical progress.

9. Review and comment on in-house simulations of the entry system performed by Blue Origin.

B. Partner will use reasonable efforts to:

1. Provide simplified Outer Mold Line (OML) definitions, e.g. CAD files, for the vehicle configurations of interest.

2. Define the flight conditions of interest.

3. Organize and run bi-weekly meetings to review technical progress.

ARTICLE 3. SCHEDULE AND MILESTONES

Deliverables listed in this Article match the numbering system from the NASA Responsibilities Article and are also referred to as subtasks. Note that the "Authority to Proceed" (ATP) requires appropriate signatures on this agreement from both Parties and a transfer of funds from the Partner to NASA ARC on a per subtask basis. Further note that the Partner can selectively fund any or all of the deliverables (subtasks) listed in this Article. Should Partner provide ATP and funding out of sequential order, NASA reserves the right to revise the estimated due date. The planned major milestones for the activities for this Annex defined in the "Responsibilities" Article are as follows:

1. Deliver aerodynamic coefficient data, aerothermal surface environment maps, and solution files for two vehicles at one flight condition of interest (NASA)	ATP + 3 months
2. Deliver aerodynamic coefficient data, aerothermal surface environment maps, and solution files for Configuration Study 1 (NASA)	Within 3 months of ATP + Blue Origin providing concepts
3. Deliver aerodynamic coefficient data, aerothermal surface environment maps, and solution files for Configuration Study 2 (NASA)	Within 3 months of ATP + Blue Origin providing concepts
4. Deliver aerodynamic coefficient data, aerothermal surface environment maps, and solution files for Configuration Study 3 (NASA)	Within 3 months of ATP + Blue Origin providing concepts
5. Deliver aerodynamic coefficient data, aerothermal surface environment maps, and solution files for Flight Condition Study 1 (NASA)	Within 1 months of ATP + Blue Origin providing concepts
6. Deliver aerodynamic coefficient data, aerothermal surface environment maps, and solution files for Flight Condition Study 2 (NASA)	Within 1 months of ATP + Blue Origin providing concepts
7. Deliver aerodynamic coefficient data, aerothermal surface environment maps, and solution files for Flight Condition Study 3 (NASA)	Within 1 months of ATP + Blue Origin providing concepts
8. Participate in bi-weekly meeting to review technical progress (Joint)	As needed
9. Review and comment on in-house simulations of the entry system performed by Blue Origin (NASA)	As needed

ARTICLE 4. FINANCIAL OBLIGATIONS

A. Partner agrees to reimburse NASA to carry out its responsibilities on a per subtask basis under this Agreement. In no event will NASA transfer any U.S. Government funds to Partner under this Agreement. Payment must be made by Partner in advance of initiation of NASA's efforts on behalf of the Partner.

Partner can selectively fund any or all of the subtasks listed in this Article, which correspond to the NASA Deliverables listed in the previous Article. Subtasks estimated costs are:

Subtasks

#	Description	Cost
1.	Preliminary aero/aerothermal simulations	$34,650
2.	Aero/aerothermal Configuration Study 1	$28,050
3.	Aero/aerothermal Configuration Study 2	$28,050
4.	Aero/aerothermal Configuration Study 3	$28,050
5.	Aero/aerothermal Flight Condition Study 1	$20,800
6.	Aero/aerothermal Flight Condition Study 2	$20,800
7.	Aero/aerothermal Flight Condition Study 3	$19,502

Each payment shall be marked with Ames, Annex Four.

B. NASA will not provide services or incur costs beyond the current funding. Although NASA has made a good faith effort to accurately estimate its costs, it is understood that NASA provides no assurance that the proposed effort under this Annex will be accomplished for the estimated amount. Should the effort cost more than the estimate, Partner will be advised by NASA as soon as possible. Partner shall pay all costs incurred and have the option of canceling the remaining effort, or providing additional funding in order to continue the proposed effort under the revised estimate. Should this Annex be terminated, or the effort completed at a cost less than the agreed-to estimated cost, NASA shall account for any unspent funds within six months after completion of all effort under this Annex, and promptly thereafter, at Partner's option return any unspent funds to Partner or apply any such unspent funds to other activities under the Umbrella Agreement.

ARTICLE 5. INTELLECTUAL PROPERTY RIGHTS - DATA RIGHTS

A. Data produced under this Annex which is subject to paragraph C. of the Intellectual Property Rights - Data Rights Article of the Umbrella Agreement will be protected for the period of five years.

B. Under paragraph H. of the Intellectual Property Rights - Data Rights Article of the Umbrella Agreement, Disclosing Party provides the following Data to Receiving Party. The lists below may not be comprehensive, are subject to change, and do not supersede any restrictive notice on the Data provided.

1. Background Data:

The Disclosing Party's Background Data, if any, will be identified in a separate document.

2. Third Party Proprietary Data:

The Disclosing Party's Third Party Proprietary Data, if any, will be identified in a separate document.

3. Controlled Government Data:

The Disclosing Party's Controlled Government Data, if any, will be identified in a separate document.

4. The following software and related Data will be provided to Partner under a separate Software Usage Agreement:

None.

ARTICLE 6. TERM OF ANNEX

This Annex becomes effective upon the date of the last signature below ("Effective Date") and shall remain in effect until the completion of all obligations of both Parties hereto, or July 13, 2023, whichever comes first, unless such term exceeds the duration of the Umbrella Agreement. The term of this Annex shall not exceed the term of the Umbrella Agreement. The Annex automatically expires upon the expiration of the Umbrella Agreement.

ARTICLE 7. RIGHT TO TERMINATE

Either Party may unilaterally terminate this Annex by providing thirty (30) calendar days written notice to the other Party.

ARTICLE 8. POINTS OF CONTACT

The following personnel are designated as the Points of Contact between the Parties in the performance of this Annex.

Management Points of Contact

NASA Ames Research Center
Matt Holtrust
Agreement Manager
Mail Stop: 202A-3
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Blue Origin, LLC
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Technical Points of Contact

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Aerospace Engineer
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Aerospace Engineer
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Kent, WA 98032-2442
Phone: (253) 275-1727
anorman@blueorigin.com

ARTICLE 9. MODIFICATIONS

Any modification to this Annex shall be executed, in writing, and signed by an authorized representative of NASA and the Partner. Modification of an Annex does not modify the terms of the Umbrella Agreement.

ARTICLE 10. SIGNATORY AUTHORITY

The signatories to this Annex covenant and warrant that they have authority to execute this Annex. By signing below, the undersigned agrees to the above terms and conditions.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AMES RESEARCH CENTER

BY: RUPAK BISWAS Digitally signed by RUPAK BISWAS Date: 2022.03.24 10:23:45 -07'00'
Dr. Rupak Biswas
Director of Exploration Technology

DATE:

BLUE ORIGIN, LLC

BY: DocuSigned by: Wade Davis 19390BCCEC5D489...
Wade Davis
Senior Commercial Advisor

DATE: 3/8/2022 | 11:20 AM PST